

## CLAIMS

1. A digital control apparatus for a switching DC-DC converter including at least one power transistor and being able to provide a regulated output voltage on a load, said apparatus comprising:

5 digital control means having for receiving a digital reference signal and for providing a modulating signal; and

a PWM device for receiving said modulating signal and providing a square wave signal for driving the power transistor of said DC-DC converter,

10 wherein said digital means operates on the square wave signal such that there is a non-linear modulation only when the value of a signal on the load is lower or higher than a prefixed value range.

2. The apparatus according to claim 1, further comprising means for driving the power transistor including means for determining the on time and the off time of said power transistor.

15 3. The apparatus according to claim 2, wherein said digital control means comprises means to increase or decrease the on time of said transistor.

4. The apparatus according to claim 3, wherein said means to increase or decrease the on time of said transistor further comprises means to increase or the decrease the value of the signal on the load with respect to a predetermined value range.  
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5. The apparatus according to claim 1, wherein said digital means further comprises means for providing a step ramp signal.

6. The apparatus according to claim 5, wherein the amplitude and the duration of said step ramp signal are programmable.

25 7. The apparatus according to claim 1, wherein said signal on the load comprises the output signal of the DC-DC converter.

8. The apparatus according to claim 7, wherein said digital control means comprise numeric comparators able to compare said output signal of the DC-DC converter with a predetermined voltage value range.

5 9. The apparatus according to claim 1, wherein said signal on the load comprises a current signal.

10. The apparatus according to claim 9, wherein said digital control means comprise numeric comparators able to compare a signal proportional to the current signal on the load with a predetermined signal value range.

10 11. The apparatus according to claim 1, wherein said PWM device comprises an analog device.

12. The apparatus according to claim 11, further comprising means for generating a ramp signal to the input to said analog PWM device.

13. The apparatus according to claim 1, further comprising a digital-to-analog converter able to convert the digital signals to the input to said PWM device.

15 14. The apparatus according to claim 1, wherein said PWM device is a digital device.

20 15. The apparatus according to claim 1, wherein said DC-DC converter comprises at least one inductor having a first terminal connected with a non-drivable terminal of said power transistor and a second terminal connected with a capacitor placed in parallel with the load.

16. The apparatus according to claim 15, further comprising a voltage positioning block having an input for receiving said output voltage and a voltage proportional to the current flowing through the inductor and an output for providing the difference voltage to the input of said control digital means.

25 17. The apparatus according to claim 16, wherein said voltage difference is subtracted from the reference signal.

18. A digitally controlled DC-DC converter comprising:

a summer for receiving a reference signal;  
a digital control block coupled to said summer;  
a DAC coupled to said digital control block;  
a PWM circuit coupled to said DAC;  
5 a DC-DC converter coupled to said PWM circuit, having an output for  
providing an output signal to a load; and  
feedback means for providing said output signal to said summer,  
wherein said digital control block provides non-linear modulation only when the  
value of a signal on the load is lower or higher than a predetermined value.

10 19. The DC-DC converter of claim 18 wherein said feedback means  
comprises an ADC.

20. The DC-DC converter of claim 18 wherein said feedback means  
comprises an adaptive voltage positioning block.